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Abstract

REACTIVITY OPTIMUM COMPENSATION IN A MULTIZONE REACTOR FROM THE POINT OF VIEW OF MAXIMUM POWER PLANT OUTPUT

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Nuclear power plant reactors have a relatively large reactivity excess during the operation with a continuous refuelling, especially with fresh fuel elements. To compensate this reactivity excess, a number of absorption rods affecting considerably the reactor power must be used. The aim of the present paper is to determine the conditions for the minimization of the power plant output losses, i.e. to determine the sequence and insertion depth of individual compensating rods.

The calculations refer to a heavy water gas cooled reactor. This reactor type has a relatively small number of technology channels. In the paper it is assumed the compensating rods affect the four immediately neighboring channels only (square lattice) and the reactor as well as the absorption rod distance are so large that the interference of the inserted rods is negligible.

Basic relations for determining the thermal output of the given technology channel as the functions of the insertion depth of the neighboring absorption rod are given. The problem is solved both for the case of a constant gas flow in the channel and for such a channel flow to retain the maximum permissible fuel element temperature. The second case is solved for two different conditions, i.e. for compensating rod insertion from the coolant inlet side and for the insertion from the coolant outlet side.

Further the paper gives the relations for the determination of the compensating rods' effect on thermal and electrical reactor output for both controlled and uncontrolled gas flow in individual channels.

The last part of the paper deals with the problem of optimum compensation of the given reactivity excess. Some functions are introduced to characterize the relative electric output loss referred to the relative absorption rod efficiency. According to the course of these functions both optimum insertion depth of the absorption rod and optimum rod insertion sequence in a multizone reactor may be determined.